

which scientific biologists have shown to be true much more generally. All objects exposed to the air and passed from hand to hand are apt to have minute organisms settling upon them, and we should expect such things as bank-notes, which pass through many hands, to be favoured by more than their usual share of "germs," knowing that simple abrasion is no satisfactory means for removing such minute bodies. Nevertheless it is interesting to see what really have been found on European bank-notes. M. Reinsch some time ago undertook to examine the money in circulation, with the result that two very small algæ, which were named as species of *Chroococcus* and *Pleurococcus* respectively, proved to be not uncommon on coins. M. Jules Schaarschmidt has since undertaken to examine the paper currency of various States, with the result that such living organisms and other objects as those in the annexed woodcut were discovered. According to the statements to hand, the notes examined were particularly those of Austro-Hungary and Russia, and new as well as old ones furnished "an abundant cryptogamic vegetation," as well as "microbes," and objects such as grains of starch, particles of hair, &c.

The entire list comprises *Bacterium termo*, the common bacterium of putrefaction; *Saccharomyces cerevisiæ*, the

servations will be made use of to bring more forcibly before the minds of our less careful brethren the dangers of handling "filthy lucre" in times of disease.

### STANDARD PITCH<sup>1</sup>

M. SORET raises the question of musical pitch, and advocates A 432, long ago proposed by M. Meerens, of Belgium. It is rather curious that in Belgium itself M. Meerens's proposal was considered and rejected by a Commission appointed in 1877, upon whose report the French pitch A 435 was adopted by Royal decree on March 19 of this year. There seems to be very little difference between the two; it amounts, in fact, to exactly 12 cents or hundredths of an equal semitone, of which  $21\frac{1}{2}$  make a comma. Hence there is no practical reason for making the change as affecting singers. But no instruments made for A 435 would be available for A 432, so that the advantage of uniformity would be lost, without any advantage to the voice or the quality of instruments. The arguments in its favour are almost entirely arithmetical. To begin with the inaudible 1 vibration and proceed by exact doubling to 64 is an arithmetical dream. It is true that König, by a most ingenious adaptation of a large tuning-fork acting in place of a pendulum to a clock going in a room at 20° C. (for about five days in a year), has succeeded in making a fork of that precise number of vibrations at that precise temperature. But at 15° C., the temperature adopted for the French *diapason normal* (standard fork), the pitch of this would not be 64, but, to take König's numbers, 64.036. The charm of the arithmetic vanishes, therefore, with a slight alteration of temperature, and the pitch has become fully 1 cent (hundredth of a semitone) sharper. Granted that this is an imperceptible amount, yet it is enough to alter the whole of the arithmetic. Then the arithmetic is itself founded on just intonation, which is not adopted anywhere. If we take the equal temperament, now generally accepted, we should get for A 432 the values C 256.9, C# 272.2, D 288.3, D# 305.5, E 323.6, F 342.9, F# 363.3, G 384.9, G# 407.8, A 432, A# 457.7, B 473.9, C 513.8. There is nothing charming here. M. Soret, in his table, quietly ignores the chromatic notes and the equal temperament. If, however, we took C 256 as the starting-point, the A of C major in just intonation would not be 432, but, as he owns, a comma flatter, 426.67. He bases everything physically on the violin, which is tuned in D and not in C, or the viola and violoncello, which are both tuned in G, not in C, and hence even for these instruments, with the great assumption of just intonation, his use of the major scale of C is incorrect.<sup>2</sup> The reasons that are to guide us in the choice of a pitch must certainly not be arithmetical. For more than two centuries up to 1813, when the Philharmonic Society was founded, all Europe used a pitch within a comma either way of Handel's fork A 422.5. Then, owing to the presentation of new instruments by the Emperor of Russia to a Vienna regiment at the Congress of Vienna, pitch rose gradually but slowly. In 1826 our Philharmonic Society, under Sir G. Smart, adopted A 433, between M. Soret's and French pitch, and this was known for many years in London as the Philharmonic pitch. France adopted A 435 in 1859. Under Costa our pitch rose to its present height, A 454.7. But our army pitch, used at Kneller Hall, and adopted for the forthcoming Exhibition, is A 452. Now, the trouble is that our classical composers wrote their music for Handel's pitch, while since 1860 Continental composers

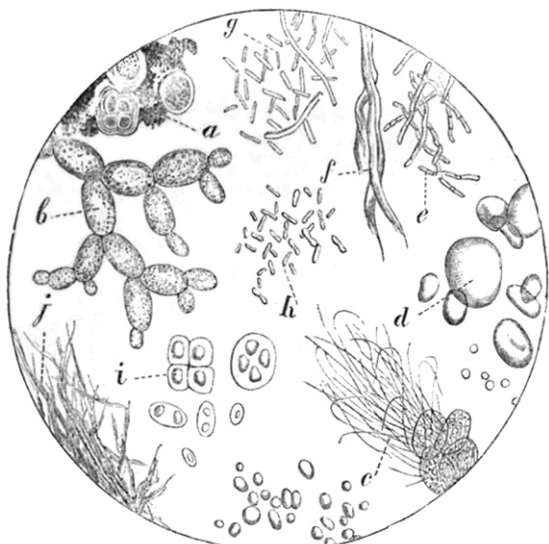


FIG. 2.—a and i, minute algæ; b, yeast cells; c, *Leptothrix*; d, starch-granules; e, g, h, various *Schizomycetes*; f and j, fibres.

yeast plant; various species of *Micrococcus*, *Leptothrix*, and *Bacillus*, as well as the two minute green algæ described by Reinsch.

We presume, in the absence of definite statements, that the groups of organisms sketched in Fig. 2 were obtained at different times, and on different notes; otherwise the "flora" is indeed a rich and abundant one, and may probably have been an isolated one, to allow the species of *Saccharomyces* to form such a fine growth.

There is obviously a very serious side to all this, however, if further researches prove that, as appears possible, our most minute and dreaded enemies are always in our midst on such apparently welcome visitants as coin and bank-notes: money will have earned a worse name even than it has heretofore! *En revanche*, there are two points which no doubt will be insisted on: in the first place, the observers named have not, so far, described any organism on the money investigated which is known to be inimical to us; and secondly, precautions have been taken from time immemorial against the transmission of currency passing from a plague-stricken community to a healthy one. Possibly the facts derived from these ob-

<sup>1</sup> J.-L. Soret, "Sur le Diapason" (*Archives des Sciences physiques et naturelles*, January, 1885. Geneva).

<sup>2</sup> Savart, whom M. Soret quotes, was in error with regard to the pitch of the resonance of Cremona violins. It was not 256 vibrations. A series of instruments examined by Mr. A. J. Ellis in 1880 gave about 270 as the primary maximum, and 252 as the secondary. But the main character was the great uniformity of reinforcement for different pitches.—See his "History of Musical Pitch."

have used French pitch, and English composers our high pitch. The first and last may compromise with the second, but are incompatible with each other. To sing Handel in modern English pitch is to unduly strain voices and spoil the effect originally intended. But we submit to it even in Handel festivals. There is a greater difficulty in altering pitch in England than on the Continent. We have no subsidised Conservatoires or theatres to which we can say: "Use this standard of pitch, or go without subsidy." Even regimental bands are not supplied at the expense of the State. A new set of instruments is very costly, and more than that, it is long before makers learn how to manufacture correctly to a new pitch. The question is therefore beset with difficulties. But the solution is certainly not to be found in the arithmetic of M. Soret.

#### THE SCIENCE AND ART MUSEUM, EDINBURGH

WE understand that Col. Murdoch Smith has been appointed by the Lords of the Committee of Council on Education to the Directorship of this Museum, in succession to the late Prof. Archer. As Lieut. Smith he was associated with Prof. Newton in the discoveries at Heliocarnassus, and, subsequently, with Commander Pacher, R.N., undertook the explorations in the Cyrenaica which resulted in the acquisition by the nation of the valuable collection of sculptures now in the British Museum. Latterly, Col. Smith, while employed at Teheran, has acquired for the South Kensington Museum the large and valuable collection of Persian art and manufactures which is so well known there. We believe Col. Smith obtained his first Commission in the Royal Engineers direct from a Scottish University, and is one of the very few officers in that Corps who did not pass through the Royal Military Academy at Woolwich or Addiscombe.

#### NOTES

WE take the following from the *Times*:—The following is the list of selected candidates recommended by the Council of the Royal Society for the election to the Fellowship:—A. W. Baird, Major R.E., P. Herbert Carpenter, D.Sc., Sir Andrew Clark, M.D., Mr. A. A. Common, F.R.A.S., E. W. Creak, Staff-Commander, R.N., Prof. E. Divers, H. Hicks, M.D., W. M. Hicks, M.A., F. R. Japp, Ph.D., A. M. Marshall, M.D., Prof. H. N. Martin, D.Sc., C. O'Sullivan, Prof. J. Perry, Prof. Sydney Ringer, and Sidney H. Vines, D.Sc.

OF the fifteen candidates who have thus been selected no less than five are Cambridge men. Mr. W. M. Hicks was bracketed seventh wrangler in the Mathematical Tripos of 1873. Prof. H. N. Martin, Prof. Milnes Marshall, and Dr. Vines were the seniors in the Natural Science Triposes of 1873, 1874, and 1875 respectively, while Dr. Herbert Carpenter obtained a First Class in the Tripos of 1874, together with Mr. J. N. Langley, who was elected to the Royal Society in 1883. The name of the late Prof. F. M. Balfour follows that of Dr. Martin in the Tripos list of 1873; while the late Prof. A. B. Garrod was senior in 1871, and the Tripos list of 1870 contains the names of Francis Darwin and E. J. Romanes. The Natural Science Triposes from 1870 to 1875, inclusive, have thus furnished no less than nine Fellows of the Royal Society, either actual or elect. The names of seven more occur in the Mathematical Tripos lists from 1871 to 1880 inclusive, viz.: J. Hopkinson (1871), J. W. L. Glaisher (1871), H. Lamb (1872), A. B. Kempe (1872), W. M. Hicks (1873), R. T. Glazebrook (1876), and J. J. Thomson (1880). To these may be added the name of Dr. W. H. Gaskell, who obtained mathematical honours in

1869, but has since devoted himself to physiology. All who know Cambridge will recognise how largely these results are due to the influence and example of the late Prof. Clerk Maxwell and of Prof. Michael Foster respectively.

WE are informed that Dr. Frankland, F.R.S., has intimated his intention to resign the Professorship in Chemistry in the Normal School of Science and Royal School of Mines at the end of the current session. Applications for the post should be addressed to the Secretary, Science and Art Department.

THE Fifty-fifth Annual Meeting of the British Association will commence on Wednesday, September 9, 1885, at Aberdeen. The President-Elect is the Right Hon. Sir Lyon Playfair, K.C.B., M.P., Ph.D., LL.D., F.R.S. L. & E., F.C.S., who will take the place of Lord Rayleigh. The Vice-Presidents are His Grace the Duke of Richmond and Gordon, K.G., Chancellor of the University of Aberdeen, the Right Hon. the Earl of Aberdeen, LL.D., Lord-Lieutenant of Aberdeenshire, the Right Hon. the Earl of Crawford and Balcarres, F.R.S., James Matthews, Lord Provost of the City of Aberdeen, Prof. Sir William Thomson, F.R.S., Alexander Bain, M.A., LL.D., Rector of the University of Aberdeen, the Very Rev. Principal Pirie, D.D., Vice-Chancellor of the University of Aberdeen, Prof. W. H. Flower, F.R.S., Pres.Z.S., Director of the Natural History Museum. General Treasurer: Prof. A. W. Williamson, F.R.S., University College, London, W.C. General Secretaries: Capt. Douglas Galton, C.B., F.R.S., A. G. Vernon Harcourt, F.R.S. Secretary: Prof. T. G. Bonney, F.R.S. Local Secretaries for the meeting at Aberdeen: J. W. Crombie, M.A., Angus Fraser, M.A., M.D., Prof. G. Pirie, M.A. Local Treasurers for the Meeting at Aberdeen: John Findlater, Robert Lumsden. The Sectional Officers are as follows:—A. Mathematical and Physical Science. President: Prof. G. Chrystal, M.A., F.R.S.E. Vice-Presidents: Prof. C. Niven, F.R.S., Prof. A. Schuster, F.R.S. Secretaries: R. E. Baynes, M.A., R. T. Glazebrook, F.R.S., Prof. W. M. Hicks, M.A. (Recorder), Prof. W. Ingram, M.A. B. Chemical Science. President: Prof. H. E. Armstrong, F.R.S. Vice-Presidents: Prof. A. Crum Brown, F.R.S., Prof. H. McLeod, F.R.S. Secretaries: Prof. P. Phillips Bedson, D.Sc., F.C.S. (Recorder), H. B. Dixon, M.A., F.C.S., H. Forster Morley, D.Sc., F.C.S., W. J. Simpson, M.D. C. Geology. President: Prof. J. W. Judd, F.R.S., Sec.G.S. Vice-Presidents: John Evans, Treas.R.S., Prof. W. C. Williamson, F.R.S. Secretaries: C. E. De Rance, F.G.S., J. Horne, F.R.S.E., J. J. H. Teall, M.A., F.G.S., W. Topley, F.G.S. (Recorder). D. Biology. President: Prof. W. C. McIntosh, F.R.S. Vice-Presidents: Prof. I. Bayley Balfour, F.R.S., Prof. J. S. Burdon Sanderson, F.R.S. Secretaries: W. Heape, J. Duncan Matthews, F.R.S.E., Howard Saunders, F.L.S., F.Z.S. (Recorder), H. Marshall Ward, M.A. E. Geography. President: Lieut.-General J. T. Walker, C.B., R.E. F.R.S., F.R.G.S. Vice Presidents: Prof. James Donaldson, F.R.S.E., John Rae, M.D., F.R.S. Secretaries: J. S. Keltie, F.R.G.S., J. S. O'Halloran, F.R.G.S., E. G. Ravenstein, F.R.G.S. (Recorder), Rev. G. A. Smith. F. Economic Science and Statistics. President: Prof. Henry Sidgwick, M.A., Litt.D. Vice-Presidents: Prof. R. Adamson, M.A., LL.D., Sir Rawson W. Rawson, K.C.M.G., C.B., Pres.S.S. Secretaries: Rev. W. Cunningham, D.Sc., F.S.S., Prof. H. S. Foxwell, F.S.S. (Recorder), C. McCombie, M.A., J. F. Moss, F.R.G.S. G. Mechanical Science. President: Benjamin Baker, M.Inst.C.E. Vice-Presidents: Prof. W. C. Unwin, M.Inst.C.E., Prof. H. C. Fleeming Jenkin, F.R.S., M.Inst.C.E. Secretaries: A. T. Atchison, M.A., M.Inst.C.E. (Recorder), F. G. Ogilvie, M.A., E. Rigg, M.A., H. T. Wood, M.A. H. Anthropology. President: Francis Galton, F.R.S., President of the Anthropological Institute. Vice-Presidents